

IPG Services

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Introduction

- Goal: Location-independent computing
- Implementing a set of services to satisfy goal
- Build upon the Globus toolkit services
- Implementing with OGSA

Service Overview

- Credential Management
 - Storage of public and private keys
- Information Services
 - Distributed directory service
 - Event service
 - User Profile
- Grid Management
 - Monitoring and Testing: Ensure the operation of a grid
 - Problem Tracking
- Application Execution
 - Job Management: Reliable job execution
 - Portability Management: Tailor a job to specific systems
 - Resource Brokering: Intelligent resource selection
- Dynamic Accounting
 - "Accountless" access
 - Grid allocations
 - Resource pricing

Credential Management

- Storing public and private keys in ~/.globus can be a hassle
 - User may use > 1 machine as their home system
- MyProxy not very good for portals
 - User must log in to a Unix box before using portal
- Service that stores public and private keys for users
- User can contact service to get a proxy
 - Provide ID and passphrase
 - Provide proxy duration and limited or full
 - Retrieve a proxy
- Use this proxy as usual

Information Services

- Distributed directory service
- Event service
- User profile service

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Distributed Directory Service

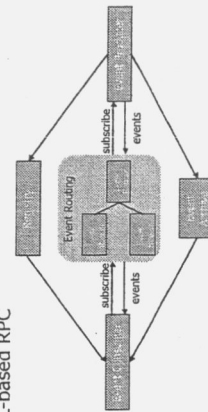
- Stores information about resources, services, applications, users, ...
- IPG is using the Globus MDS
- Analyze and improve performance of the MDS
 - ♦ IPG MDS has slow response times
- Extend information schemas
 - ♦ Scheduler, installed software, benchmarking
- Refine information schemas
 - ♦ Number of nodes != number of CPUs

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Event Service

- Publish/subscribe model
- Archive Events
- Registry
 - ♦ Producers, consumers, archives, routing
- Existing system
- Layer atop OGSA
 - ♦ Currently using XML-based RPC
- Add functionality
 - ♦ Event routing
 - ♦ Event archives



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User Profile Service

- Maintain a profile for each user
- Systems they prefer
- Environment they expect on each system
- Grid .cshrc

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Grid Management

- Monitoring and testing service
 - ♦ Observe and report failures before users see them
- Problem tracking service
 - ♦ Interface local problem tracking services

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Monitoring and Testing

- Observe and report failures before users see them
- Combination of active and passive tests

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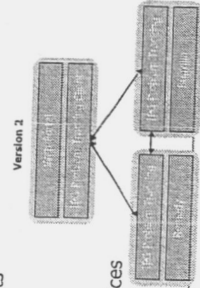


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Problem Tracking

- A user finds a problem on a grid
- How does the problem get resolved?
 - ♦ Grid-wide support email lists
 - ♦ Local problem tracking systems
- Problem: Where to submit a trouble ticket?
- Interface to local problem tracking services
- Initial version
 - ♦ Interface to send problem reports
 - ♦ Web portal
- Next version may
 - ♦ Query problem status
 - ♦ Move tickets between local services



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Dynamic Accounting

- Dynamic resource access
 - ♦ Use resources without previous per-user authentication
- Grid allocations
 - ♦ Charge resource use to remote allocations
- Resource pricing
 - ♦ Maintain prices for resource use
 - ♦ Set prices for resource use

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Dynamic Resource Access

- Use resources without previous per-user authentication
 - ♦ E.g. Unix account
- Critical for scalable resource access
 - ♦ Don't want to apply for 100s of accounts
- Sites have full autonomy
- Sites can set user acceptance policy
 - ♦ "dynamic access is ok for Glenn users"
- Must be able to track all user access
 - ♦ Log mapping of grid ID to Unix username

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Allocation Management

- Maintain user and group allocations
- Charge resource use to remote allocations
 - ♦ Run at Glenn, charge to Ames
- Allocation units
 - ♦ Standard units
 - ♦ Conversion between units
- Balance of payments
 - ♦ Center A uses Center B more than vice versa

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Resource Pricing

- Maintain prices for resource use
 - ♦ Owners set prices
 - ♦ Users query prices
- Investigate techniques to set prices
 - ♦ Agreement
 - Based on performance or uniqueness
 - ♦ Market-based

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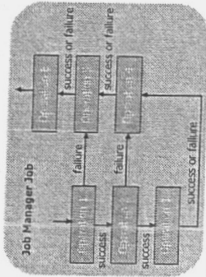
Application Execution Services

- Job management
 - ♦ Executing jobs on a grid
- Portability management
 - ♦ Making jobs portable
- Resource brokering
 - ♦ Selecting where to run

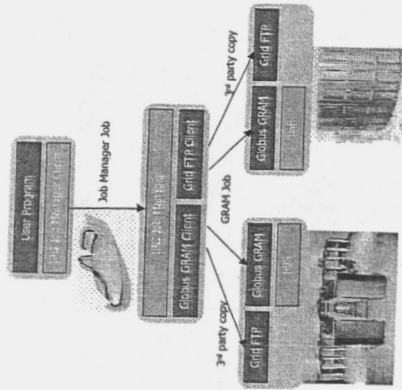
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- Reliable execution of a job
- ◆ Job consists of operations
 - File operations: copy and delete files, copy and delete dirs
 - Execution operations
 - Specified exactly (hosts, paths, environment)
- Notification of job state change
- Maintain job database
- Designed to run a complex task (not a workflow)

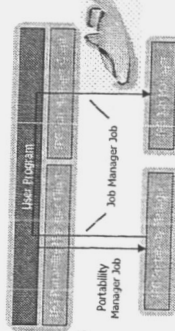


Job Management



Portability Management

- Help run jobs in a portable way
 - ✦ System-independent job -> system-dependent job
 - Portability Manager job
 - ◆ Same structure as Job Manager job
 - ◆ System-independent
 - Don't have to set system-dependent characteristics
 - Creates Job Manager job
 - ◆ System-dependent
 - ◆ Sets directories (home, scratch)
 - ◆ Picks correct executable
 - ◆ Sets environment variables (e.g. paths)
 - ◆ Adds files to stage for libraries
 - Maintain software repositories
 - ◆ Executables and libraries
 - ◆ Data grid
-
- The diagram illustrates the workflow of the Portability Manager. It shows a 'User Programs' box at the top, which contains sub-boxes for 'User Programs', 'User Programs', and 'User Programs'. An arrow points from the 'User Programs' box to a 'Portability Manager Job' box, which in turn points to a 'Job Manager Job' box. The 'Portability Manager Job' box is labeled 'Portability Manager Job' and the 'Job Manager Job' box is labeled 'Job Manager Job'.



Resource Brokering

- Performance Prediction
 - ◆ Predict start times and execution times of applications
 - ◆ Predict file transfer times
- Resource Selector
 - ◆ Selects where to execute applications and where to obtain data
- Resource Broker
 - ◆ Executes a system-independent job
 - ◆ Uses Resource Selector, Portability Manager, Job Manager

Performance Prediction

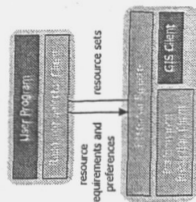
- Predict execution time of applications
 - Use coarse information
 - User name, executable name, arguments, number of CPUs, ...
 - Historical database
 - Instance-based learning
 - Find similar experiences in database (distance function)
 - Form prediction from them (kernel regression)
- Predict scheduling queue wait times
 - Monitor scheduling queues
 - Simulate scheduling algorithms
- Predict file transfer times
 - Monitor network performance
 - Time series analysis

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Resource Selector

- Selects resources for a job
- User specifies requirements and preferences
 - Resource characteristics
 - Operating systems, hosts, performance, cost, location
- Information obtained from
 - Grid information service
 - Resource characteristics
 - Accounting: Access, allocations, prices
 - Performance prediction services
- Returns a list of resource sets
 - Each job may require multiple resources
 - All resources meet user requirements
 - Sets are ranked by fitness

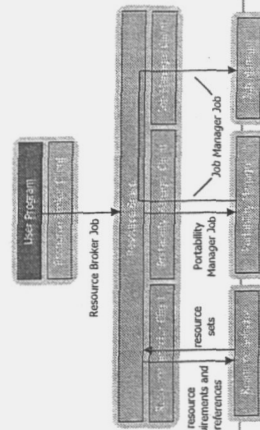


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Resource Broker

- Executes a system-independent job
- Uses Resource Selector to select resources
- Uses Portability Manager to create system-dependent job
- Uses Job Manager to run job
- Redo process if job fails or executes slower than expected



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Current Status

- Initial versions of
 - Event service
 - Job Manager
 - Resource Selector and Broker
 - Next versions in development
- Developing
 - Monitoring and Testing
 - Portability Manager
 - Performance prediction
 - Dynamic Accounting
 - MDS evaluation
- Availability
 - NASA only for now
 - Working on permission for wider releases

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